

PATENT ABSTRACTS OF JAPAN

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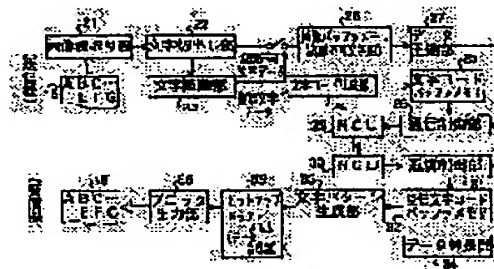
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(54) FACSIMILE EQUIPMENT

(57)Abstract:

PURPOSE: To relax congestion of transmission traffic and to send a beautiful picture without missing of information of an original picture even when an OCR cannot recognize a character by using the OCR so as to compress transmission data quantity through the character recognition thereby reducing the transmission time with respect to the facsimile equipment.

CONSTITUTION: A picture read section 21 reads a transmission original 15 and a character segmentation section 22 segments character, information and a character recognition section 23 recognizes a character. The recognized character is coded by a character code generating section 24 and the result is sent. Character information unable to be recognized is stored in a picture buffer memory 26 as bit map information and compressed in a data compression section 27 and the result is sent together with character code information. The received character code information is given via a reception character code buffer memory 32 in a character pattern generating section 33 and synthesized in a bit map buffer memory 35 together with the bit map information expanded by a data expansion section 34 and outputted from a plotter output section 36.



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[Title of Invention] Facsimile Apparatus

[Claims]

A facsimile apparatus with Optical Character Reader (OCR) comprising image scanner, character detecting portion, and character recognizing portion, wherein the image scanner converts a character on a surface of a draft paper into an image information, and the character area detecting portion defines character area from the image information, and the character recognizing portion identifies the character as codes based on the image information, the facsimile apparatus further comprising:

A transmitter includes means for transmitting the coded image information of the character and means for transmitting a bitmap image information, wherein the codes of the character are generated by character recognizing portion based on the coded image information of the character, and the bitmap image information wherein the image information of the character corresponding to the codes of the character has not been identified by the character recognizing portion; and

A receiver includes means for forming a character pattern converted from the coded pattern information of the character which has been transmitted, and means for data synthesis, wherein received bitmap image information and the pattern information of the character are synthesized.

2. The facsimile apparatus of claim 1 further comprising the means for transmitting an image information restrictive of a character area(s) wherein the character image information have been recognized by the character recognizing portion, as a bitmap image information after replacing the character image information in the area by a blank data.

3. The facsimile apparatus of claim 1 or 2 further comprising means for making a decision, whether only bitmap information should be transmitted, or both a bitmap information and a character code information of characters should be transmitted, based on the rate of recognition of characters expressed by the number of recognized characters recognize by the character recognizing portion to that of the character areas recognized by the character area detecting portion.

[Detailed Description of the Invention]

[0001]

[Field of the Invention]

The present invention relates to a facsimile apparatus, especially to those having a function to read a character on the surface of a draft paper directory utilizing an Optical Character Reader (OCR).

[0002]

[Prior Art]

Recent development in researches related to character

recognition improved the rate of character recognition of Optical Character Reader (OCR) used as a data entry device for computers including personal devices. In the mean time, facsimile apparatus in compliance with G3 standard protocol is capable of performing character communication with certain terminals using Echo Canceller Method (ECM).

[0003]

For example, Fig.7 illustrates the elements of typical OCR entry device in block diagram. The OCR entry device of Fig.7 has an image scanner 1 which reads images on draft papers. Using line image sensor 2, the image scanner 1 converts image on a surface of a draft paper, line by line into electrical signals, then video amplifier 3 amplifies the signals, and the signals are digitized by digitizer 4, then the digital data are stored in line buffer 5.

The information in line buffer memory 5 is processed by a fine image compensator 6 to process a fine portion(s) in the of character, and character area detecting portion 7 picks up the area occupied by every character, judging the line alignment and spaces between characters, then character feature extracting portion 8 normalizes the size of the extracted character pattern, and conduct edge extracting treatment of the character, and character recognizing portion 9 recognizes the character with reference to data in character dictionary 10, then character code generator 11 converts every character into codes, referring

to the contents of character code pattern memory circuit 12 in which the pattern of every character is expressed by character code(s) through pattern matching.

The generated character codes are stored in a buffer memory (not shown), then transmitted through an interface circuit 14. Above described elements are controlled by a microprocessor 13, and the sub-scanning motor 18 is used for moving line image sensor 2 or the draft paper sequentially in order to read the draft line by line.

[0004]

When the character codes for all characters within one page of the draft are generated, the recognized characters by OCR are displayed on a host CRT (not shown). The unrecognized characters can be entered manually by an operator for correction through device such as a keyboard. If above mentioned OCR technology is used in facsimile apparatus, the images can be transmitted with higher quality and reduced amount for data communication. Therefore, facsimile apparatus with OCR function is now under development.

[0005]

For example, the conventional facsimile apparatus of this kind are described in Japanese Patent Publication of Unexamined Application Nos. H1-256861, H1-291572 and H1-305485.

[0006]

[Problems to be Solved by the Present Invention]

However, such conventional facsimile apparatus, as described in Japanese Patent Unexamined Application, Publication No. H1-305485, can prevent errors in recognition of characters raised during the transmission of an image information between the facsimile apparatus equipped with an OCR, but is incapable of correct errors if OCR fails to recognize characters.

[0007]

A facsimile apparatus described in Japanese Patent Unexamined Application, Publication No. H1-256861 process received information in the receiving site after distinguishing whether the information is a bitmap image information or a character code. In the case when a conventional OCR fails to recognize and convert a character into corresponding character code, OCR assign and outputs a character code such as code for '?' so that an operator can correct the draft by key entering the unrecognized character. However, this method of correction can not be used by the receiver of facsimile document, since the unrecognized character can not be re-entered by looking up the original draft. The reliability of facsimile communication declines if a draft with unrecognized character is sent since the missing information can never be recovered.

[0008]

A facsimile apparatus seen in Japanese Patent Unexamined Application, No. H1-291572 can distinguish the capability of

receiving site to process character code, and decide whether draft is sent in a bitmap image information or character code. However, even if the receiving site can process character code, an unrecognized character can never be converted into a character code if a draft with an unrecognized character code is sent from the sending site.

[0009]

An object of the present invention is to shorten the time of document transmission and to reduce data traffic by compressing the amount of data to be sent using character recognition of OCR. Another object of the present invention is to provide a facsimile apparatus capable of sending clear image without missing original information even if OCR fails to recognize a character.

[0010]

The facsimile apparatus of claim 1 of the present invention having an image scanner which converts an image on the surface of a draft paper into corresponding digital image information, and a character area detecting portion which extracts a character information from the digital image information, and a character recognition portion which recognize a character information so as to assign a code for the character information characterized in that:

A transmitter includes means for sending a character, which has been recognized as a character, as corresponding

character code, and means for sending a character information which has not been recognized as a character by the character recognition portion, as a bitmap information.

A receiver includes means for generating a character code pattern which converts received character code information into a character pattern information and a data synthesis portion which synthesizes the bitmap information and the character information.

The invention of claim 2 is characterized in that the means for sending a bitmap information is capable of sending an image information as a bitmap information wherein the character areas corresponding to the characters recognized by the character recognition portion are replaced with a "white" data.

The invention of claim 3 is characterized in means for automatically making a decision about whether only bitmap information should be sent or both bitmap information and character information should be sent to the receiving site according to the character recognition rate which is defined as a ratio of numbers of recognized characters in the character recognition portion to the number of character areas detected by the character area detecting portion.

[0011]

[OPERATION OF THE INVENTION]

In the claim 1 of the invention the character information

recognized as a character information by the character recognition portion is assigned corresponding character code and other remaining character information which is not recognized as a character information is designated as a bitmap information. They are both sent to receiving cite and there the character code information is converted into a character pattern and then a synthesized information product of both information is output. Consequently, the character information which is recognized and converted into a character code by the OCR is compressed, so that transmission of the character information can be achieved within a short period of time so that load to a crowded data transmission lines be relieved and a clearer image of character than that of the original draft will be sent. Those characters not recognized by OCR are sent as standard bitmap information, so as to improve the reliability of communication wherein missing of information is prevented.

[0012]

Claim 2 of the present invention, especially when the draft is composed of both drawing(s) and characters, the character information recognized by the character recognition portion is converted into character codes and other information, i.e. the image information derived from areas excluding those of recognized characters is sent as a bitmap information. Consequently, the draft containing both drawing(s) and characters is able to be sent without missing any image

information on the draft and thus achieving high degree of transmission reliability of information and drawing(s) and clear characters can be sent within a reduced transmission period since the amount of data to be sent will be reduced as a whole due to data compression of character information.

[0013]

In the invention of claim 3, the method of sending information is selected according to the rate of character recognition defined as the number of recognized characters vs the numbers of corresponding character areas or blocks in the draft. If a draft, for instance, is mainly occupied by drawing(s) with relatively small number of character areas or when number of character areas or blocks is large with low character recognition rate, then the draft should be sent as a bitmap information alone since not so much improvement in image quality of the draft is expected. In case other than above, the information with both bitmap and character codes should be sent so that the whole amount of the data for transmission is reduced achieving improvement of image quality. As described above the selection of the method of sending the image information can be automated by adjusting number of character blocks or character recognition rate through evaluation of each draft with respect to the above predetermined criterion.

[0014]

[DESCRIPTION OF THE PREFERRED EMBODIMENTS]

A mode for carrying out the present invention is described with reference to the figures. Fig.1 and Fig.2 show a construction of the facsimile apparatus according to the embodiment of claim 1 of the present invention.

[0015]

As shown in Fig.1, the OCR of the facsimile apparatus of this embodiment is composed of an image scanner 21, a character area detecting 22 and a character recognition portion 23. In a sending site of the facsimile apparatus, a means for sending character code operates as follows: a draft paper 15 is scanned and character areas are detected by the character detecting portion 22 followed by recognizing characters in the character recognition portion 23. The recognized character data is converted into corresponding character codes by a character code generator 24 and these character codes are stacked in a character code buffer memory 25. The character codes are then sent to a modem in a communication controller 28 where modulated signals are sent out to a public telephone communication line through a NCU 29 (communication network control unit).

[0016]

As a means for sending a bitmap information, the unrecognized characters in the character recognition portion 23 are stacked in an image buffer 26, and then the image data is compressed by a data compressor 27 and are modulated in a communication controller 28 where the modulated signals are sent out to a public

telephone communication line through the NCU 29.

As a means for generating character pattern at a receiving site, the signals received by a NCU 30 is demodulated in a modem in a communication controller 31, and then stacked in a received code buffer memory 32 followed by being converted into corresponding character patterns by character pattern generator 33.

[0017]

A means for data synthesis is composed of a bitmap buffer memory 35, where the compressed bitmap information at sending site is decompressed by a data magnifier 34, and the image is reconstructed by synthesizing the bitmap information with the character patterns. The synthesized image is printed out by means of a plotter 36 resulting a draft 16 received.

[0018]

Now the working effects of the present invention will be explained. Fig.2 illustrates a flow stream of the draft in both sites of sending and receiving and under transmission by the facsimile apparatus of Fig.1. The surface of the draft paper 15 containing original inmate is scanned by the image scanner 21, and the character areas are detected by the character area detector 22. Here, as shown in Fig.2, in the case when three letters of "D", "G" and "L" are not recognized, the rest of the characters are converted into character codes individually by the character code generator 24 and are stacked in the character

code buffer memory 25, while unrecognized three characters of "D", "G" and "L" are stacked in the image buffer memory 26 as a bitmap information. After the completion of the above procedures for one page of the draft paper, then such items as strings of character codes and blocks or areas of unrecognized characters, address information of characters indicating locations of each characters in the processed draft and information about font and size of each character are sent to the communication controller 28 as attributive information for a unit of line or column of characters in the draft where character codes and unrecognized character blocks are sent separately through the communication network control unit (NCU) 29.

[0019]

On the receiving site, when at least one line of character information has been sorted and synthesized from separately transmitted character information by the character synthesis portion, i.e. the bitmap buffer 35, the received character information is printed out by means of the plotter 36. As illustrated in the received image in Fig.2, those characters other than "D", "G" and "L" are printed in a better quality than original by using the character code generator 24 on the sending site, since the character patterns are generated based on the corresponding character codes by the character pattern generator 33 on the receiving site.

Furthermore, the unrecognized characters "D", "G" and

"L" are output as bitmap information level without omission eliminating an opportunity of missing an important information and this will render and maintain reliability to the facsimile data transmutation.

It is also possible to have an operator input correct data by a keyboard after confirmation of the unrecognized character(s) visually achieving uniformity of characters throughout the information and these operation will enables a receiving party to record and manage the draft from the sending site in a suitable recording medium such as a floppy disk of a word processor.

[0020]

The OCR process of the present invention should not be limited to the method of pattern matching described in the description of the prior art of the present invention. The object of recognition should not be confined to alphanumeric character but may include "kana" and "kanji". Further, the OCR process may be applied to other types of character than printed format such as those hand-written. Fig.3 and Fig.4 illustrate another embodiment in claim 2 of the present invention.

[0021]

Since basic construction according to this embodiment is almost same as schematically shown in Fig.1, description is confined to the characteristic features avoiding duplicated description. As shown in Fig.3, the means for sending bitmap

information of claim 2 is characterized in a white (empty) data replacement portion where the character areas having characters recognized by the character recognition portion 23 are replaced by empty data.

[0022]

According to this specific feature, the draft 15 consisting of a drawing and characters as shown in Fig.4, can be subjected to character area detection and the areas where characters are recognized are replaced as a whole by a white region the white data replacement portion 37. As shown in the OCR processed draft 15a, the areas excluding those for "shi" and "za", both of which are not recognized as characters, are replaced by white data and resulting OCR processed draft 15a, an image information, is stacked in the image buffer memory 26 as a bitmap information and sent to the receiving site after data compression in the data compressor 27 in a usual manner for data compression. Therefore, the more the number of areas or blocks for recognized character, the more white or empty areas in the OCR processed draft 15a which may approaches to the image of all-white with high rate of compression. Since recognized characters are sent as character codes, the total amount of information is significantly reduced, thus sorting the time of transmission avoiding data traffic confusion.

[0023]

As shown in the received draft 16 in Fig.4, non-character

information such as drawing(s) or text boxes is sent as a conventional bitmap information so as to prevent missing of information, and to maintain original image quality. In addition, recognized characters are output at receiving site with higher image quality than the original draft.

[0024]

Fig.5 and Fig.6 illustrate an embodiment of claim 3 of the facsimile apparatus of the present invention. Fig.5 illustrates the construction of sending site of facsimile apparatus of claim 3 in a block diagram. The characteristic feature of the construction of claim 3 is that the rate of character recognition is calculated by the number of character areas or blocks detected by the character area detector 22 and the number of recognized characters recognized by the character recognition portion 23. According to the rate of character recognition it is selected and judged whether the draft image should be sent only by bitmap information or in a format wherein character codes and bitmap information are mixed.

[0025]

More specifically, the data of one draft page scanned by the image scanner 21 is stacked in the page memory 38 in Fig.5 and the number of recognized characters are counted by a recognized character counter 39, then the counted number is input to a OCR data judgment port 40. Also the number of characters unrecognized by the character recognition portion 23 is counted

by a unrecognized character counter 41, then the counted number is input to the OCR data judgment port 40.

[0026]

The number counted in the recognized character counter 39 and the number counted in the unrecognized character counter 41 are added at the OCR data judgment port 40 providing number of detected character areas or blocks by the character area detector 22. The rate of recognition is calculated by dividing the number of recognized characters counted by the recognized character counter 39 by the number of character areas or blocks. The rate is compared with a previously adjusted value, and a switch 42 is controlled base on the comparison.

[0027]

The operation is described as below. As shown in the flowchart of Fig.6, the image scanned by the image scanner 21 is stacked in the page memory 38 at step S100. Characters areas detected by the character area detector 22, and converted into a character code by the character recognition portion 23 at step S101, then the number of recognized characters is counted by the recognized character counter 39 and the resulted number is compared with a previously adjusted value A of the OCR data judgment port 40 at step S102.

[0028]

If the number of recognized characters is larger than A, it is proceeded to step S103. Then, if the rate of recognition

is larger than B, is proceeded to step S104, and a call if made, and the switch 42 is controlled based on a protocol at step S105. At step S106, if the receiving site is found to be capable of receiving OCR draft at step S106, a draft is sent in a mode in which both character code(s) and bitmap information are mixed.

[0029]

If the number of recognized characters is less than A, or if the rate of character recognition is less than B, call is made at step S108, then the switch 42 is controlled based on a protocol at step S109, and the draft is sent only with bitmap information at step S110. As described above, a draft is sent according to an automatic selection of either character code/bitmap mixed or bitmap alone so that best image can be sent without having an operator to consider the contents of the draft.

[0030]

The embodiment of the present invention should not be limited to application to facsimile apparatus, but is applicable to OCR itself and recognition of hand-written character.

[0031]

[ADVANTAGES OF THE PRESENT INVENTION]

According to the invention of claim 1, OCR communication mode allows sending and receiving images of a character in higher image quality than that in original draft, while preventing missing of information by sending in a conventional bitmap information in case of failure of recognizing the character and

this will reduce total amount of data to be transmitted and leads to an decrease in transmission period.

[0032]

According to the invention of claim 2, an equivalent advantage of claim 1 of the present invention is achieved for a draft including both caricatures and drawing(s), since recognized characters are converted into character codes and a bitmap information excluding recognized characters is sent together with the character codes.

According to the invention of claim 3, a draft is sent with automatic selection of either bitmap information alone or character code/bitmap mixed information depending on the condition of the draft so that best facsimile image can be sent by the most adequate mode keeping consideration about conditions of a draft and a receiving site.

[BRIEF DESCRIPTION OF THE DRAWING]

Fig.1 is a block diagram showing the construction of a facsimile apparatus according to an embodiment of claim 1 of the present invention.

Fig.2 shows sending/receiving image and data under transmission.

Fig.3 is a block diagram showing the construction of a facsimile apparatus according to an embodiment of claim 2 of the present invention.

Fig.4 shows sending/receiving image and data under transmission.

Fig.5 is a block diagram showing the construction of a facsimile apparatus according to an embodiment of claim 3 of the present invention.

Fig.6 shows a flow chart explaining the operation of a facsimile apparatus of claim 5.

Fig.7 is a block diagram showing the construction of a conventional OCR device.

[DESCRIPTION OF REFERENCE NUMERALS]

- 15 draft paper
- 15a OCR processed draft
- 16 received draft
- 21 image scanner
- 22 character area detector
- 23 character recognition portion
- 24 character code generator
- 25 character code buffer memory
- 26 image buffer memory
- 27 data compressor
- 28 communication controller
- 29 NCU(communication network control unit)
- 30 NCU(communication network control unit)
- 31 communication controller
- 32 received character code memory

- 33 character pattern generator
- 34 data magnifier
- 35 bitmap buffer memory
- 36 plotter
- 37 empty data locator
- 38 page memory
- 39 recognized character counter
- 40 OCR data judgment port
- 41 unrecognized character counter
- 42 switch

一チャートに示されるように、読取りが開始されるとステップ100で画像読取り部21で読み取った画像情報をページメモリ38へ格納する。次に、文字切出し部22で文字情報が切り出され、文字認識部23で文字認識処理が行われると(ステップ101)、認識文字数が認識文字カウンタ39でカウントされ、その結果がOCR通信制御部40の所定の値Aと比較される(ステップ102)。

【0028】認識文字数がA以上の場合は、ステップ103に移行し、さらに文字認識率がB以上の場合は、ステップ104に移って読取り行われ、所定のプロットコルに従って切換えスイッチ42の切換え処理等が行われる(ステップ105)。ステップ106で相手側受信機にOCR受信能力がある場合は、ステップ107で文字コードとビットマップ情報とが現在したモードで送信する。

【0029】また、認識文字数がAよりも小さいか、又は文字認識率がBよりも小さい場合は、ステップ108で発呼が行われ、ステップ109のプロットコルに従って、切換えスイッチ42の切換え処理等が行われ、ビットマップ情報のみで画像情報が送信される(ステップ110)。このように、原稿の文字ブロック数や文字認識率を原稿毎に判断して、文字コード/ビットマップ情報の現在送信か、ビットマップ情報のみの送信かが自動的に選択されるので、オペレータが原稿内容を意識することなく、常に良好な画像情報を適切に送信することができる。

【0030】なお、本実施例では、ファクシミリ装置に適用した例を示したが、これ以外に単体のOCRや情報機器に本発明を応用することも可能である。

【0031】

【発明の効果】請求項1記載の発明によれば、OCR通信モードを使って原稿以上に良好な品質の文字画像が送信できると共に、OCRで認識できない文字があっても、通常のビットマップ情報として送信するので、情報の欠落が防止され、伝送データ量の低減に伴って伝送時間を短縮することができる。

【0032】請求項2記載の発明によれば、認識できた文字情報を文字コード化すると共に、画像情報から除いてビットマップ情報として併せて伝送するので、絵などの文字情報以外の情報が含まれた原稿であっても、請求項1と同様に好適な効果を得ることができる。請求項3記載の発明によれば、送信画像を通常のビットマップ情報のみで送信する場合と、文字コードとビットマップ情報を現在させて送信する場合とを原稿の画像状態に応じ

て自動的選択するので、原稿や相手先に合った最適なモードでファクシミリ画像を送信することができる。

【図面の簡単な説明】

【図1】請求項1記載の発明に係るファクシミリ装置の一実施例の構成を示すブロック図である。

【図2】図1の送受信画像と送信データを示す図である。

【図3】請求項2記載の発明に係るファクシミリ装置の一実施例の構成を示すブロック図である。

【図4】図3の送受信画像と送信データを示す図である。

【図5】請求項3記載の発明に係るファクシミリ装置の一実施例の構成を示すブロック図である。

【図6】図5の動作を説明するフローチャートである。

【図7】従来例のOCR装置の一構成例を示すブロック図である。

【符号の説明】

15 送信原稿

15a 認識処理送信原稿

16 受信原稿

21 画像読取り部

22 文字切出し部

23 文字認識部

24 文字コード生成部

25 文字コードバッファメモリ

26 画像バッファメモリ

27 データ圧縮部

28 通信制御部

29 NCU

30 通信制御部

31 受信文字コードバッファメモリ

32 文字バターン生成部

34 データ伸長部

35 プロット出力部

37 白データ置換部

38 ページメモリ

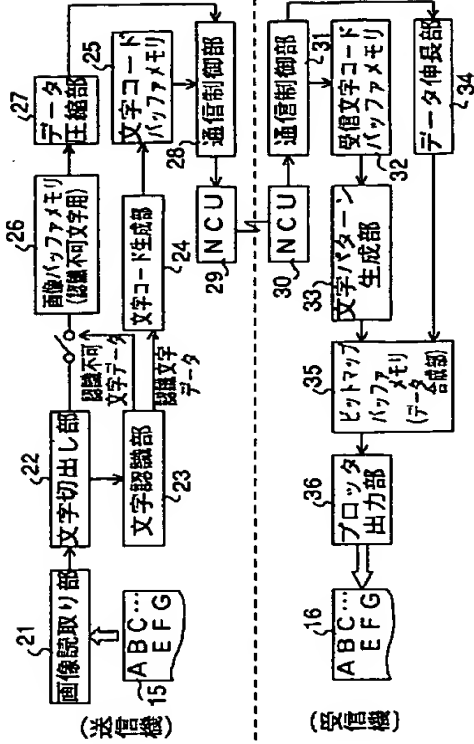
39 認識文字カウンタ

40 OCR通信探査判定部

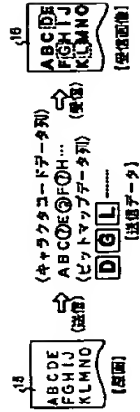
41 認識不可文字カウンタ

42 切換えスイッチ

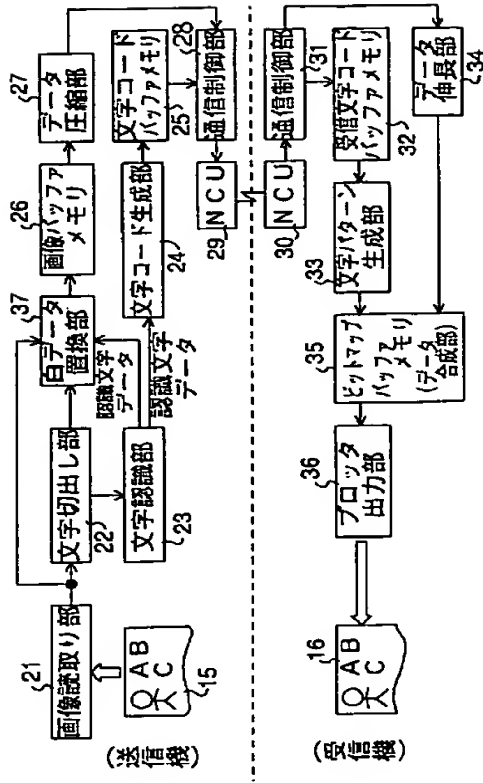
【図1】



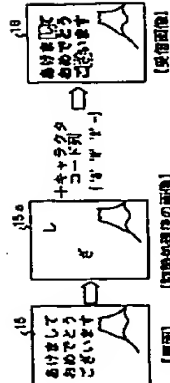
【図2】



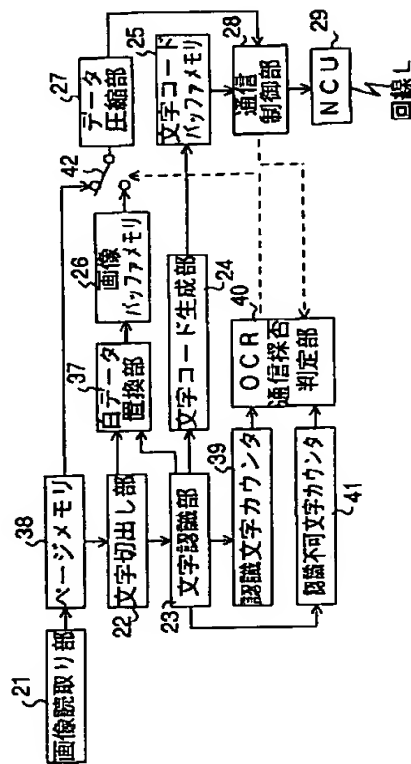
【図3】



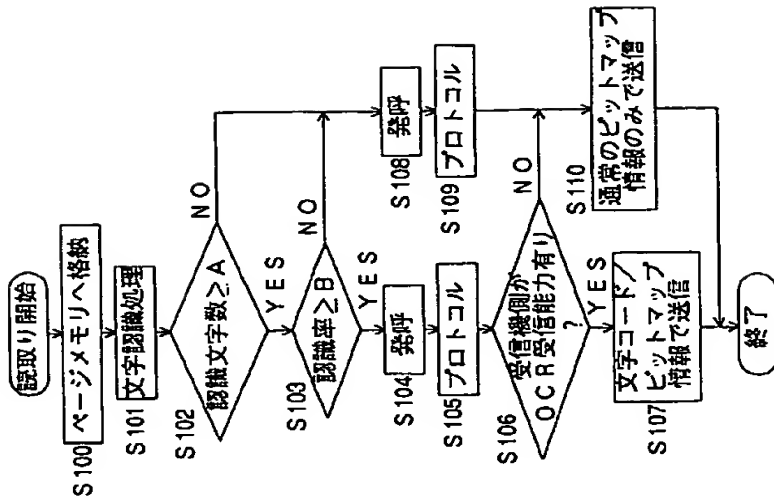
【図4】



【図5】



【図6】



【図7】

